



Living Labs in Architecture: Open innovation and co-creation towards a more sustainable architecture and lifestyle

Speakers:

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Abstract: *Living Labs in Architecture can be tools towards a holistic knowledge generation and transmission, using real built environments for user-centred research and innovation as well as collaborative learning at a university campus and beyond.*

The present article describes existing living lab concepts and definitions, focusing on co-creation processes, methodologies for open innovation, and participatory learning approaches, with the LOW3 solar house living lab at UPC-Barcelona Tech as case study.

Outcomes and lessons learned can serve as example for similar initiatives, establishing Architecture Living Labs as open, collaborative learning environments, innovation arenas, and places of social interchange, empowering communities in their learning and progress towards a more sustainable lifestyle.

Keywords: *Living Labs, co-creation, innovation, sustainable lifestyle, participation*

1. Introduction

Today society faces the need of empowering its citizens and communities towards a more active role regarding decision processes, which affect its economic, societal and environmental well-being.

The modification of the mechanisms of our socio-economic system, the setting of new goals and the implementation of new strategies which allow reducing the environmental impact of our society as a whole, together with the individual transformation of people's values, attitudes and behaviours, seem to be urgent to assure a healthy, prosperous and equal future for the present and all coming generations.

Nowadays the environmental impact of our lifestyles in industrialized countries is mainly related to housing, mobility and consumption. Technological solutions like energy efficient systems, products and services might contribute to the reduction of this impact. Nevertheless a whole transformation process of society is needed, and social innovations as well as behavioural changes are essential in these transformation processes towards a more sustainable society as a whole.

To experience alternatives, innovate in new ways of living and co-create scenarios for a more sustainable lifestyle, lighthouse projects, prototype buildings and generally places to meet,



learn and experience together can serve communities to build up this necessary knowledge. These projects can help co-creating new solutions as well as building up common future scenarios. They allow reflecting about and subsequently changing attitudes and behaviours.

On the other side citizens as users of technologies, products and services have been discovered as important contributors within innovation processes. User-centred research and user co-creation have been strongly developed and implemented during the last decade in order to accelerate research and development processes, obtaining user feedback through observation and evaluation in real-life environments or directly through open-innovation processes.

Living Labs are research and innovation infrastructures which apply this user-centred approach, bringing together different stakeholders in a physical place in order to generate within a real-life setting innovative solutions for technologies, products or services, offering a huge potential for creating holistic solutions for a more sustainable society.

2. Living Labs in Architecture as innovation tools between teaching and research

Applying the concept of a living lab to projects of sustainable housing prototypes in the context of academia, a specific type of Architecture Living Lab can be defined as a place for linking innovation to collaborative learning and co-creation activities.

This type of Architecture Living Labs can foster synergies between the knowledge triangle of teaching, research and innovation in the field of sustainable housing and lifestyle. In the context of local communities they can serve as multi-stakeholder platforms, fostering its transformation processes towards a more sustainable model of society.

Laboratories for construction, building physics or technological research and development traditionally focus on specific areas of knowledge and less on a holistic multidisciplinary approach. Their capacity to generate relevant output in fields like user acceptance of technology, user-technology interaction or the holistic impact analysis of technological innovations on life-style and society is therefore limited. The development of “Living Labs” has been a step forward in bridging this gap.

2.1 State of the Art

Since more than 10 years Living Labs evolve within the European R+D+I context as organizations which structure and provide governance to user involvement within “innovation arenas” where different stakeholders can experiment and innovate in real life environments.

Chesbrough (2003) introduced the term of Open Innovation describing the collaboration between internal R&D departments with external partners, benefiting from the generated synergies within a structured collaboration process. [1]

Shuurman et. al (2013) propose living labs as a common place where both forms of distributed innovation processes, open innovation and user innovation, can be brought together. These two forms of innovation would be linked through co-creation processes, as collaborative development of innovation among different stakeholders. [1]

Ballon et al (2005) defines a living lab as “An experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered ‘co-producers’.” [2]

According to Almirall et al. (2012) this establishes a clear link to other forms of user participation in innovation processes like *lead users* or *open source communities*, which can adopt the role of the principal creators of innovation, whereas in the field of *user-centered design* users adopt a more passive role, giving insight or being observed for usability, human interaction or market validation exercises. [2]

Nevertheless the abundant literature about living labs, this particular approach to innovation today still seem to lack a clear definition beyond generic, descriptive parameters like user participation, user co-creation or multi-stakeholder innovation network. Despite of a great variety of living lab initiatives, their concepts and organizational structures as well as their specific characteristics are diverse and common frameworks for applied methodologies are still under development.

2.2 Living Lab Networks and initiatives

With regard to the Living Lab approach, several Living Lab networks and platforms have been founded since approximately the year 2000.

One of the fastest growing networks of Living Labs is the ENoLL (European Network of Living Labs). It was founded in 2006 and today (May 2014) has more than 450 Living Lab initiatives linked to it. ENoLL describes the need for Living Labs with the necessity of fastening the market availability of innovations through user-centred research and user co-creation. These concepts are based on the idea that, through immediate user feedback in real world environments, researchers and developers in collaboration with users are able to create and improve innovations and assure market viability within very short periods. This is an efficient alternative to traditional research and innovation processes. Only a small part of the ENoLL initiatives are focused on sustainable architecture and lifestyle, with a strong emphasis on social research and a culture of change.

In the last years, specific research and innovation infrastructures and projects have been created that focus on Net Zero Energy Buildings (NZEB) and Sustainable Lifestyle. One is the Norwegian Research Centre on Zero Emission Buildings at NTNU (Trondheim, Norway). It focuses not only on zero emission technologies but also on user behaviour and lifestyle. [3]

Another important initiative is the LIVING LAB project, a funded European FP7 project for Living Labs, directed by the Wuppertal Institute which had the idea of creating a network of



standardized living labs in different climatic and social-economic environments in Europe, thereby allowing the comparison of results through similar physical settings. [4]

2.3 Solar Decathlon Prototype Houses as potential living labs

Since 2002, the international Solar Decathlon competition promotes the development of energy self-sufficient solar houses by universities; fostering during the latest competitions, especially in Europe, a holistic view on sustainable architecture, including the aspects of urban density, shared facilities and infrastructure as well as energetic renovation processes. More than 120 prototypes have been developed and built during the last decade.

The efficiency of the Living Lab approach, together with the transdisciplinary and holistic concept of the Solar Decathlon solar houses define the potential of these prototypes for being converted into living laboratories in the field of sustainable architecture and lifestyle.

The following case study of the Living Lab LOW3 project at UPC-BarcelonaTech describes the specific concept for an Architecture Living Lab within academia, but with a strong link to the local community it is embedded in, and therefore with an extraordinary potential to support local learning, innovation and transformation processes.

3. Living Lab LOW3 – concept and outcomes

LOW3 is the 2010 Solar Decathlon Europe prototype solar house of UPC BarcelonaTech, which since 2011 serves as Living Lab for sustainable architecture and life style at the ETSAV campus at Sant Cugat with the aim to offer a holistic platform for education and innovation based on user-centred research and user co-creation. [5]

3.1 Objectives and methodology

Living Lab LOW3 is defined as an open platform for teaching, research and innovation in the field of sustainable architecture and lifestyle.

Main objectives of Living Lab LOW3 are:

- Constitute an open innovation platform for user-centred research and user co-creation in a real-life environment (prototype solar house)
- Install regular educational activities for Higher Education with extension to society
- Link applied research and innovation activities with companies in the field of sustainable architecture and life style
- Create a social platform for interchange and collaboration in the field of sustainable architecture and life style
- Apply living lab methodologies and open innovation strategies with participation of multiple stakeholders (academia, industry, society, administration)



The aim is to link innovation to collaborative learning and co-creation activities, fostering synergies between the knowledge triangle of teaching, research and innovation in the field of sustainable housing and lifestyle.

The involvement of the city of Sant Cugat and the educational offers for secondary schools allowed collaboration in education for sustainability, opening Living Lab LOW3 to the citizenship of its municipality as another group of “users” beyond academia and industry.

3.2 Living lab activities

A huge variety of activities have been linked to LOW3 as living lab platform for sustainable architecture and lifestyle. Beside regular teaching activities within its academic framework, Living Lab LOW3 opened up to society through educational visits for secondary school, guided visits to general public of its community, specialized visits for experts from different disciplines, and the dissemination of the generated knowledge through broadcastings, the Living Lab blog and social media.

Through co-creation and innovation seminars Living Lab LOW3 contributed to the generation and further development of initiatives in the field of sustainability locally and also within an international context.

Projects reached from urban renewal projects for energy efficiency with self-employment and a strong social component, through cooperatives for sustainable local development up to existing businesses in the field of local, ecological agriculture and possible links to educative activities as well a collaborative project of *therapeutic gardening* for a neighbourhood in Barcelona.

Collective brainstorming techniques and co-creation strategies were applied to generate creative ideas. At the same time interesting networking opportunities were generated and social component of the seminar allowed personal conversations and contacts between the participants.

As a university living lab, three official Living Lab LOW3 courses and several complementary activities have been completed since 2011. The “LIVE AT LOW3” experiment – the house occupation with 2 students during 2 weeks and holistic evaluation of their lifestyle and impact through the participating student team – allowed the first real application of a user-centred research approach.

Collaboration in industrial research projects on concentrated solar power systems and energy storage in buildings generated additional knowledge and synergies among participants.

Several other activities related to teaching, projects and dissemination with more than 1200 participants in more than 3 years show the important contribution of Living Lab LOW3

Figure 2 shows the diverse activities linked to the Living Lab LOW3 project, from formal teaching and applied research activities, to co-creation seminars, social events, knowledge dissemination and non-formal co-learning activities.



Figure 2: Living Lab LOW3: Teaching, research and innovation activities regarding sustainable architecture and lifestyle

Each activity has been documented. An individual analysis and evaluation has been carried out in order to evaluate the success of each initiative, analyse the lessons learned, and gather information about possible improvements.

3.3 Outcomes and lessons learned

After more than 3 years of implementation, field experience and continuous evaluation, the following lessons could be learned from the Living Lab LOW3 project:

- SDE prototype houses like LOW3 are ideal objects to be converted into Living Labs for sustainable architecture and lifestyle at universities, but proven methodologies and documented experiences on strategies, tools and outcomes are still rare.
- Living Lab LOW3 facilitates the generation of participatory co-learning activities that allow collectively generating and distributing new knowledge.
- A dynamic learning environment with formal and non-formal activities from workshops and seminars up to co-creation seminars, user-centred research activities and knowledge dissemination for the general public has been created.
- Living Lab LOW3 opened up to society supporting the knowledge generation on important matters like sustainable architecture, sustainable lifestyle and smart cities.
- Indicators are needed to describe and compare Living Lab projects and their structure, allowing benchmarking of different Living Lab initiatives.

4. Conclusions

Open innovation and co-creation towards more sustainable lifestyles of our society need a multistakeholder approach and university-society collaboration with a holistic vision and new methods and tools.

Collaboration, co-creation or synergies cannot be forced to happen within the diverse context of universities and local communities in general. Nevertheless, places and infrastructures can be created that facilitate these essential processes. Architecture Living Labs might be places, which foster this kind of processes.

Further development of the relatively new Living Lab approach is necessary. Methodologies and tools are in constant change, and experiences on national and international level will generate new knowledge that helps evolve the initial concepts.

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